

ELECTRICAL POWER DISTRIBUTION SYSTEMS

NUR ADLINA
MOHD ARIFF







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The background of the cover is a photograph of a sunset or sunrise sky with orange and yellow clouds. Several black power lines and poles are visible, stretching across the frame from the bottom left towards the top right. The title text is centered in the upper half of the image.

ELECTRICAL POWER DISTRIBUTION SYSTEMS

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Hj. Mohd Ariff bin Ramli**

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EDITION 2022

First Publishing 2022

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Published by:

Department of Electrical Engineering

Politeknik Sultan Mizan Zainal Abidin

KM. 08, Jalan Paka, 23000 Dungun, Terengganu

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Nur Adlina Mohd. Rani, 1983-

ELECTRICAL POWER DISTRIBUTION SYSTEMS / Nur Adlina binti Mohd Rani,
Hj Mohd Ariff bin Ramli.

Mode of access: Internet

eISBN 978-967-0047-09-6

1. Electric power distribution.

2. Electric power systems.

3. Power transmission.

4. Government publications--Malaysia.

5. Electronic books.

I. Mohd. Ariff Ramli, 1983-.


II. Title.

621.319

ELECTRICAL POWER DISTRIBUTION SYSTEMS
EDITION 2022

e-ISBN 978-967-0047-09-6

PREFACE



In the name of Allah, The Most Gracious and Merciful.
All praise to Allah S.W.T for His great loving kindness
and blessing, this E-book is successfully published.

The authors would like to express deepest
appreciation to all those who provided the possibility in
publishing this E-book especially friends and
colleagues. Many thanks also go to the Electrical
Engineering Department team for the support and
guidance throughout the process of completing this
E-book.

Thank You.

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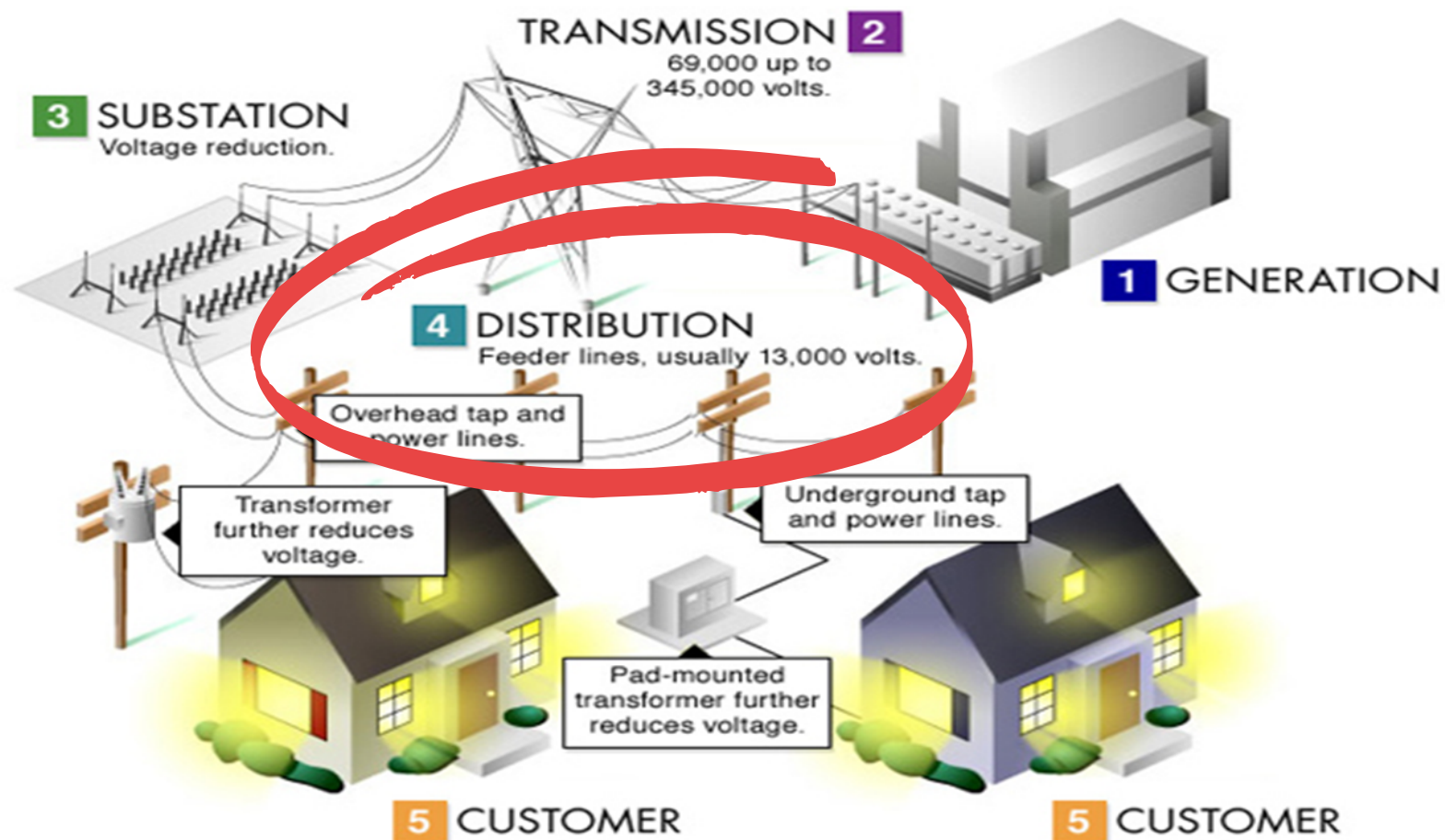
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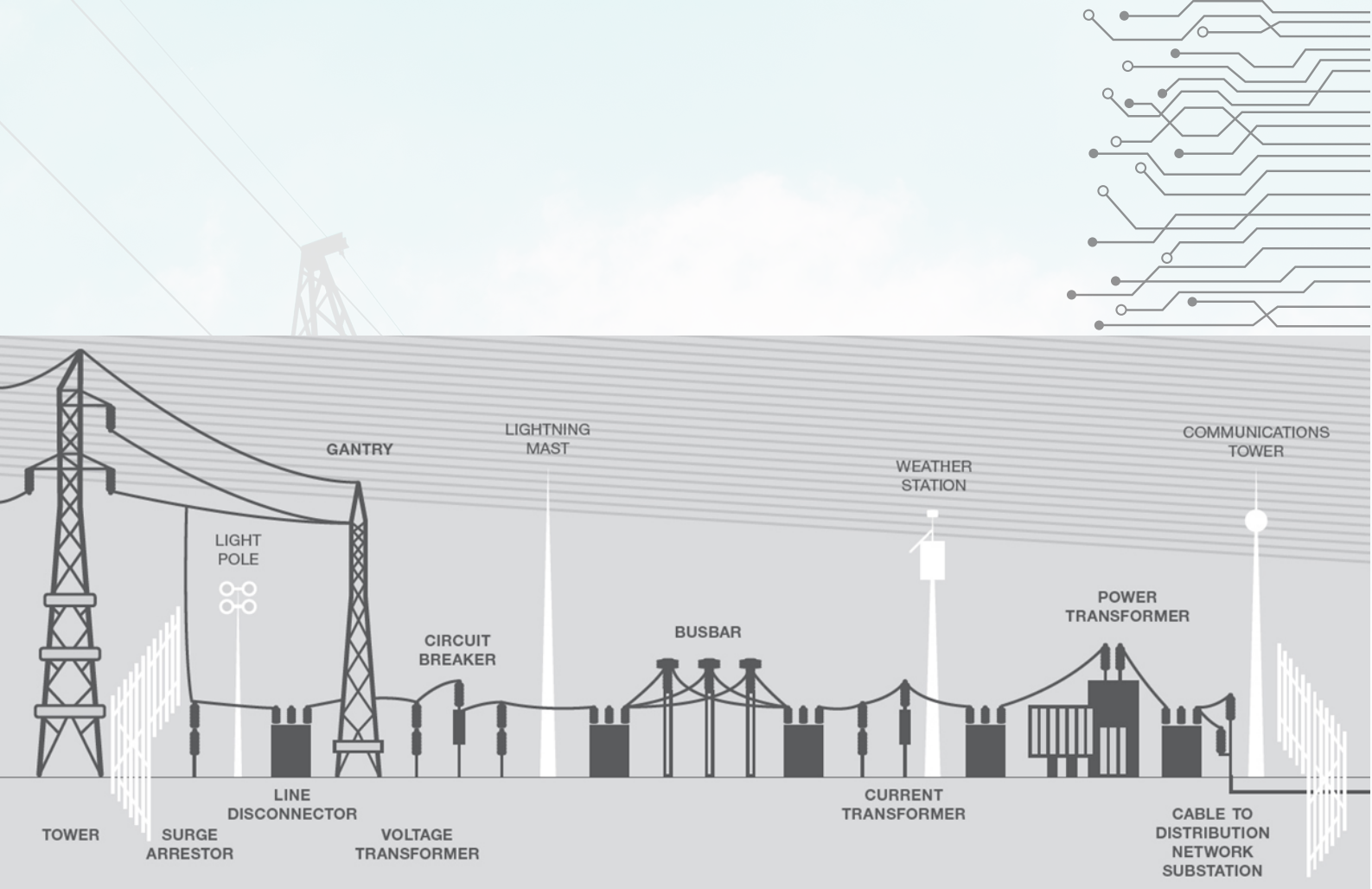
ABSTRACT

This digital writing will provide students with the concepts of electrical power distribution systems such as their functions, energy efficiency, role of distribution substations, busbar arrangement, and the characteristic of distribution cables. It is organized base on syllabus of Power System (DET30053) course,
Department of Electrical Engineering,
Polytechnic of Malaysia.

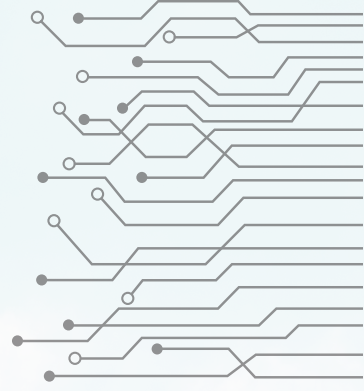
INTRODUCTION TO DISTRIBUTION SYSTEM



An Overview



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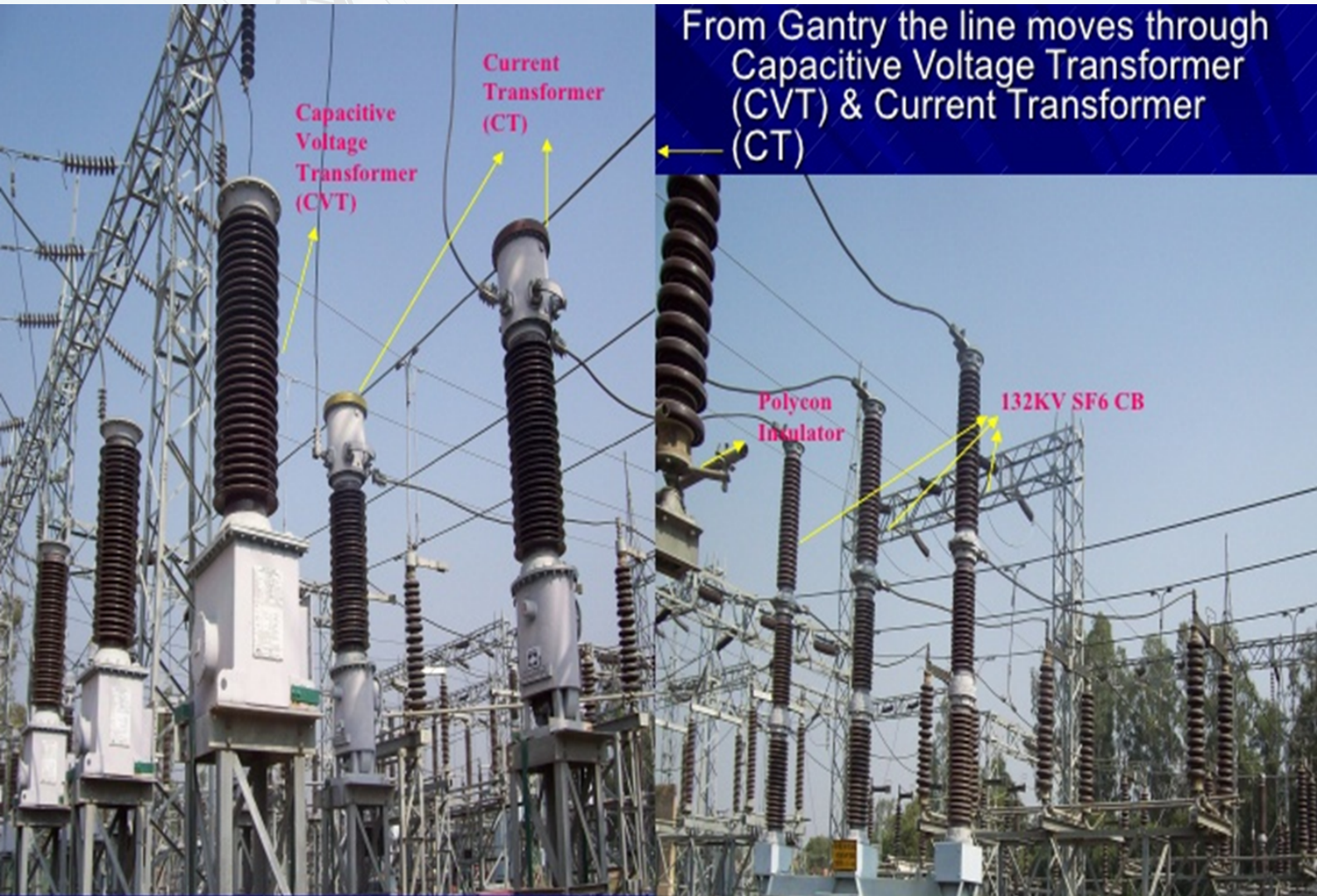


Visit

**Substation
132/33 kV**

132kv incoming lines through Lightning Arrestor & is connected to the Gantry through insulated discs.







The line ,through the isolators is distributed in the s/s through Main bus.



Tendum Isolator

Tendum isolator, used for rectification works to isolate the equipment

40MVA 132/11kv transformer feeding PGI

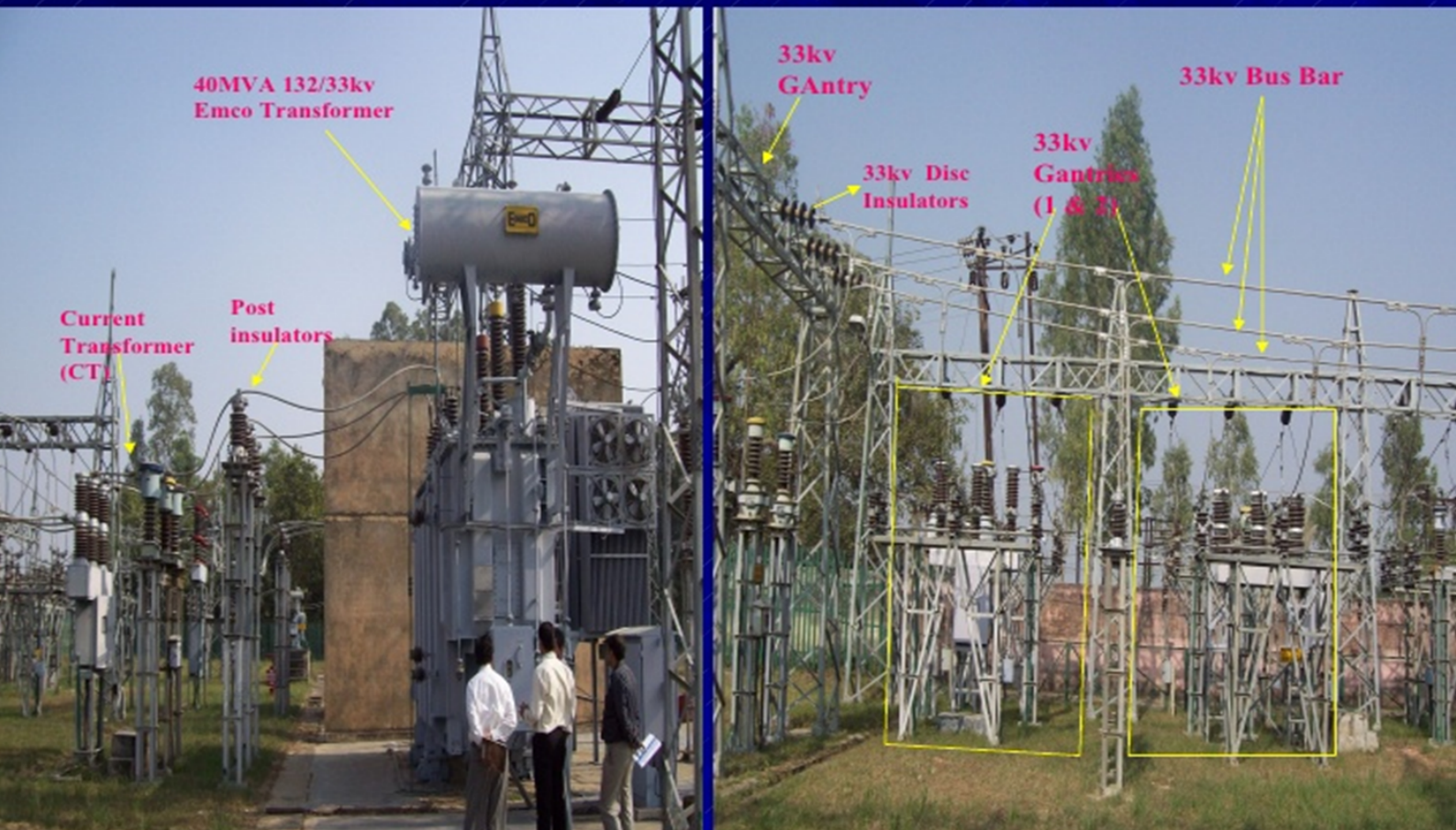


Current Transformer (CT)

Transformer Core

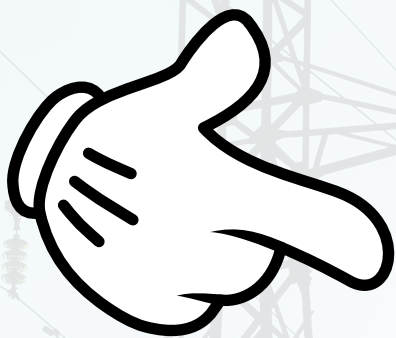
Transformer LA

33kv Sub-station with two 40MVA(132/33kv) transformers





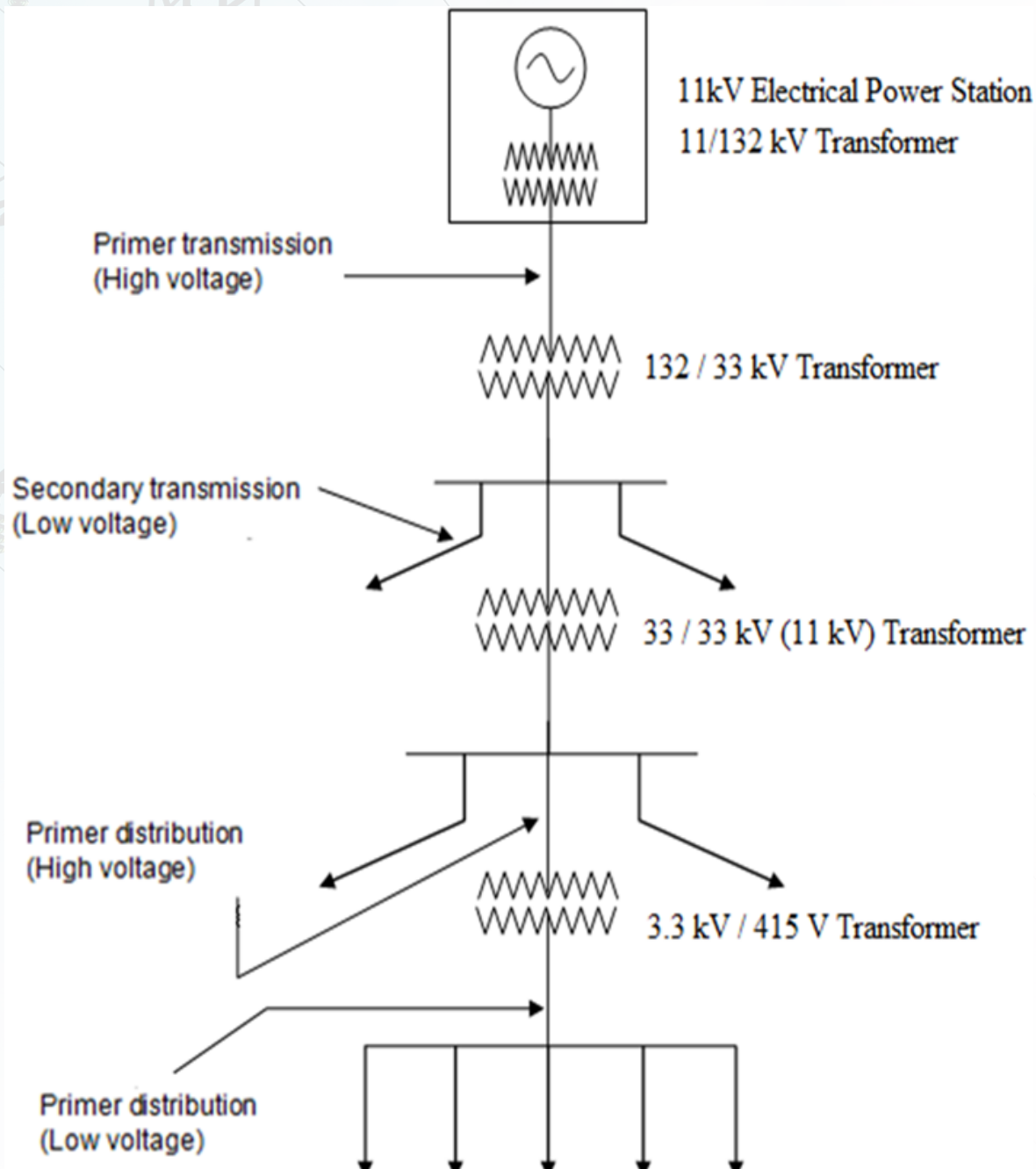
End of Visit...



NOW
HERE
WE GO TO...

ELECTRICAL POWER
DISTRIBUTION SYSTEM

FLOW OF DISTRIBUTION SYSTEM



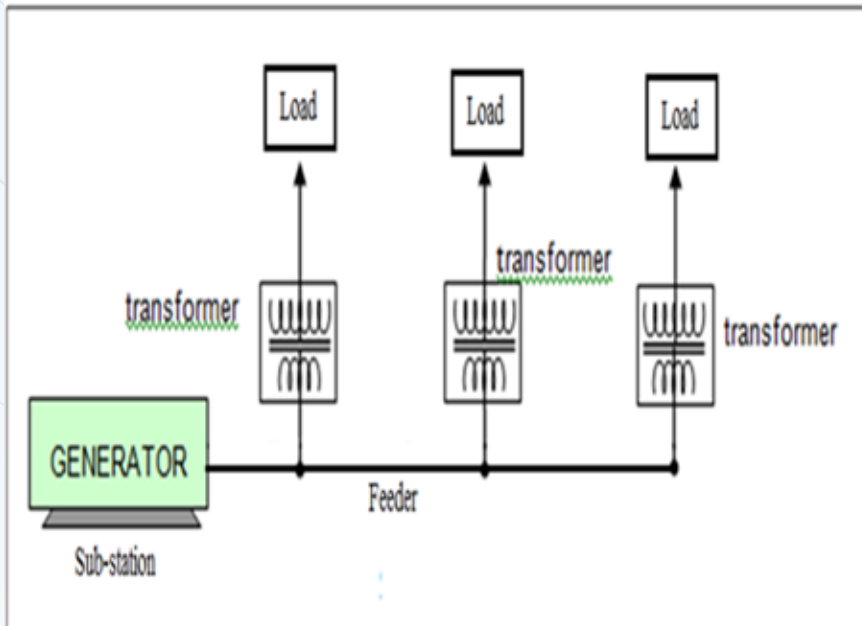
FEEDER ARRANGEMENT IN ELECTRICAL POWER DISTRIBUTION SYSTEM

WHAT IS FEEDER?



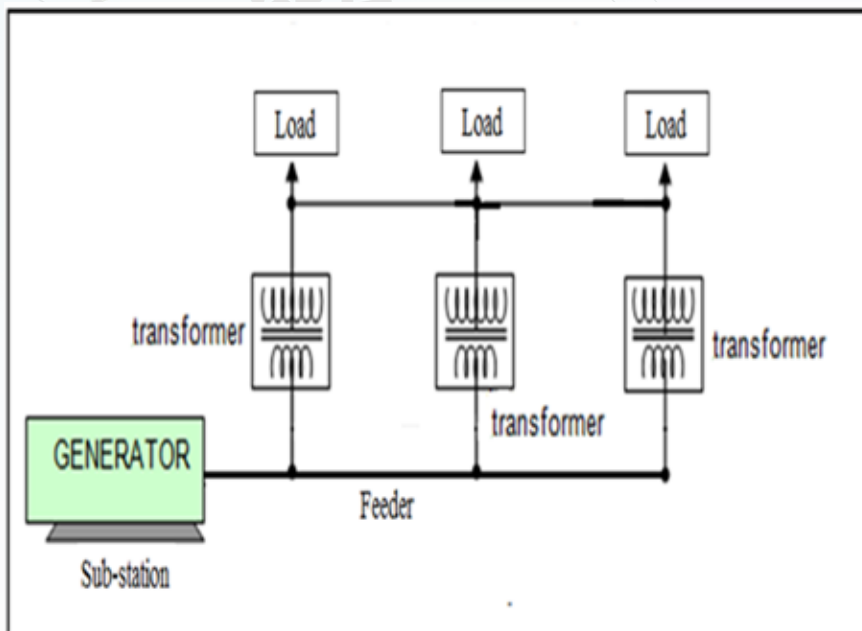
In electric power distribution, **Feeder** is "voltage power line transferring power from a distribution substation to the distribution transformers"

ARRANGEMENT OF THE FEEDER



1

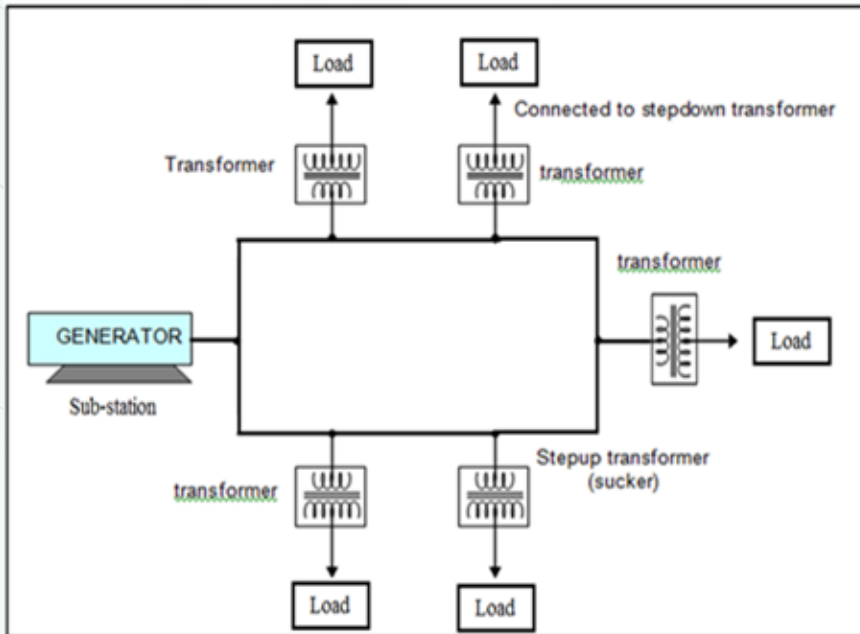
RADIAL



2

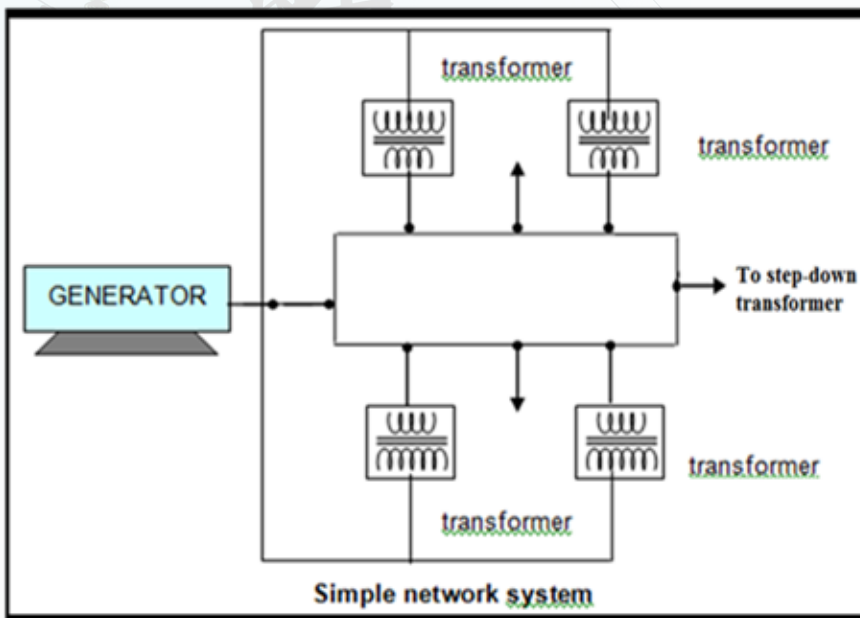
PARALLEL

DISTRIBUTION ARRANGEMENT OF THE FEEDER



3

R I N G



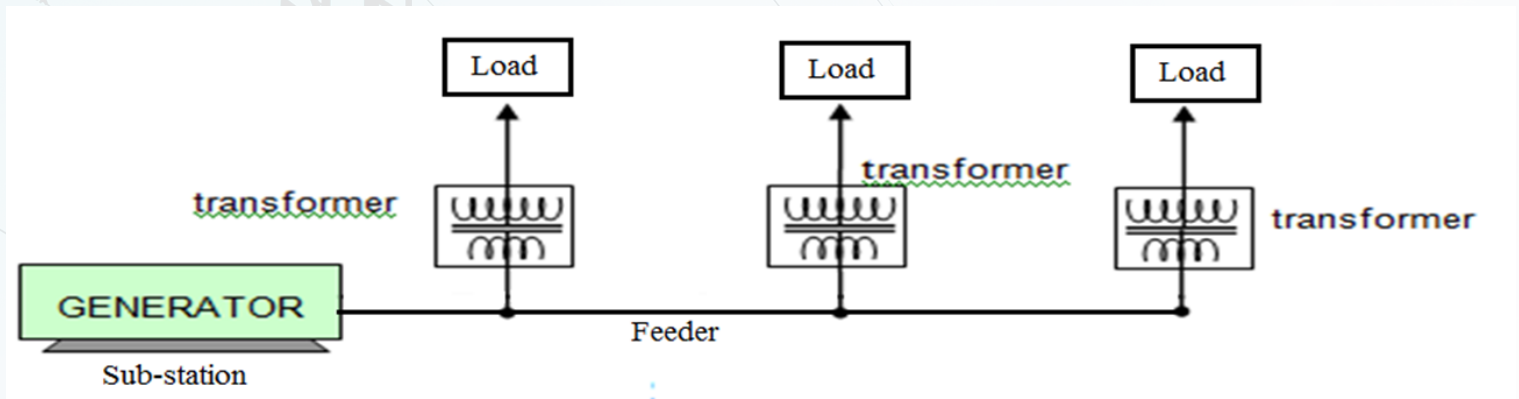
4

S I M P L E
N E T W O R K

DISTRIBUTION ARRANGEMENT OF THE FEEDER

1

RADIAL

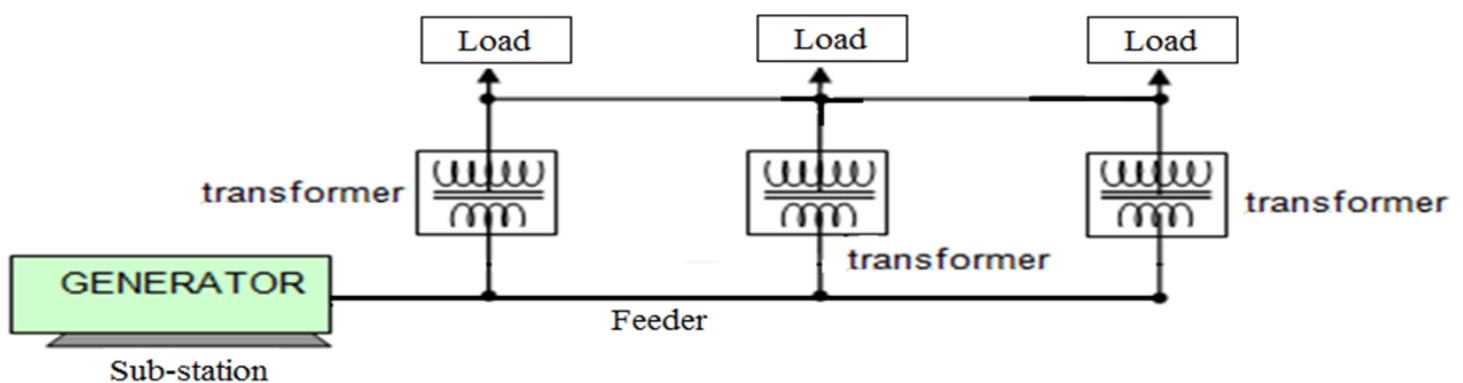


- Radial system is a distribution system connected from a supply that has only one end.
- The end closest to the source of much suffering burden.
- It is the cheapest way but if one of the transformers damaged, other transformers will not function.
- Widely used in small areas or supply connections to houses in a row.
- It can be fixed with the circuit breaker in each transformer, so that the damaged transformer can be repaired without interrupting the supply to other load.

DISTRIBUTION ARRANGEMENT OF THE FEEDER

2

PARALLEL

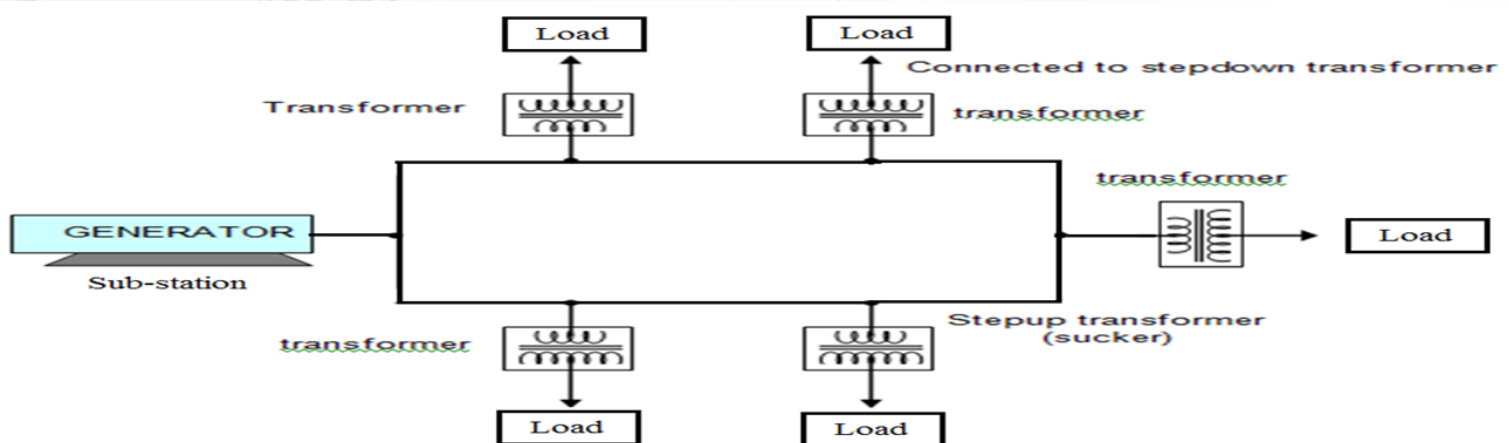


- Used to overcome problems in radial system.
- It is similar to the radial but the secondary part of the transformer connected to each other.
- So, if one transformer is damaged, the electricity can still be supplied to consumers through other transformers connected in parallel with it.

DISTRIBUTION ARRANGEMENT OF THE FEEDER

3

RING

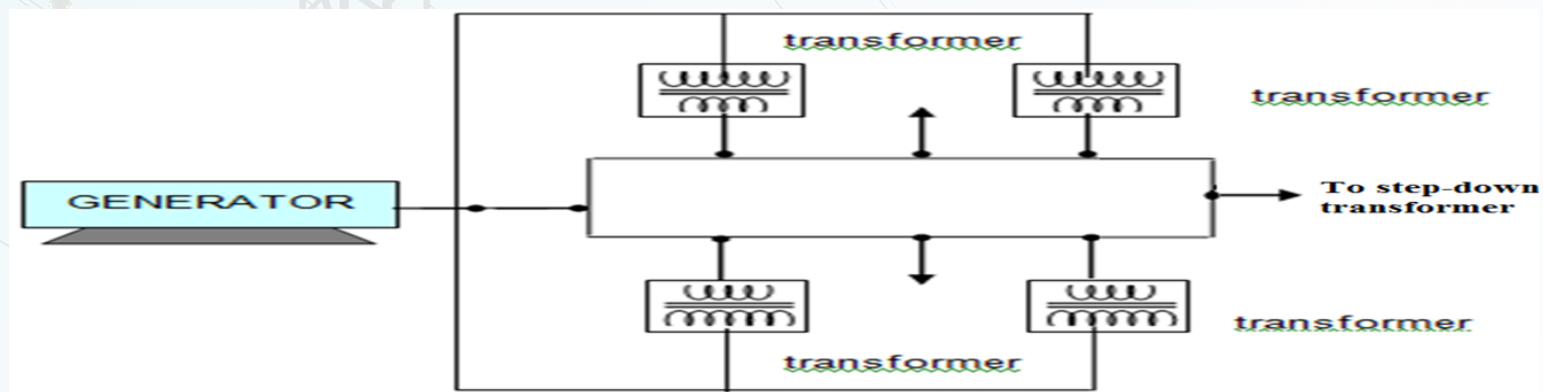


- It is made by connecting all the step-up transformers in one area such as village, city or state in the ring circuit.
- It only involves the primary side of the transformer, whereas the secondary side of the transformer is installed directly to other transformer.
- Voltage drop is considered not exist.
- The system can accommodate a lot of burden even their small size.
- Extralong loads easily made through the duct into the ring circuit.

DISTRIBUTION ARRANGEMENT OF THE FEEDER

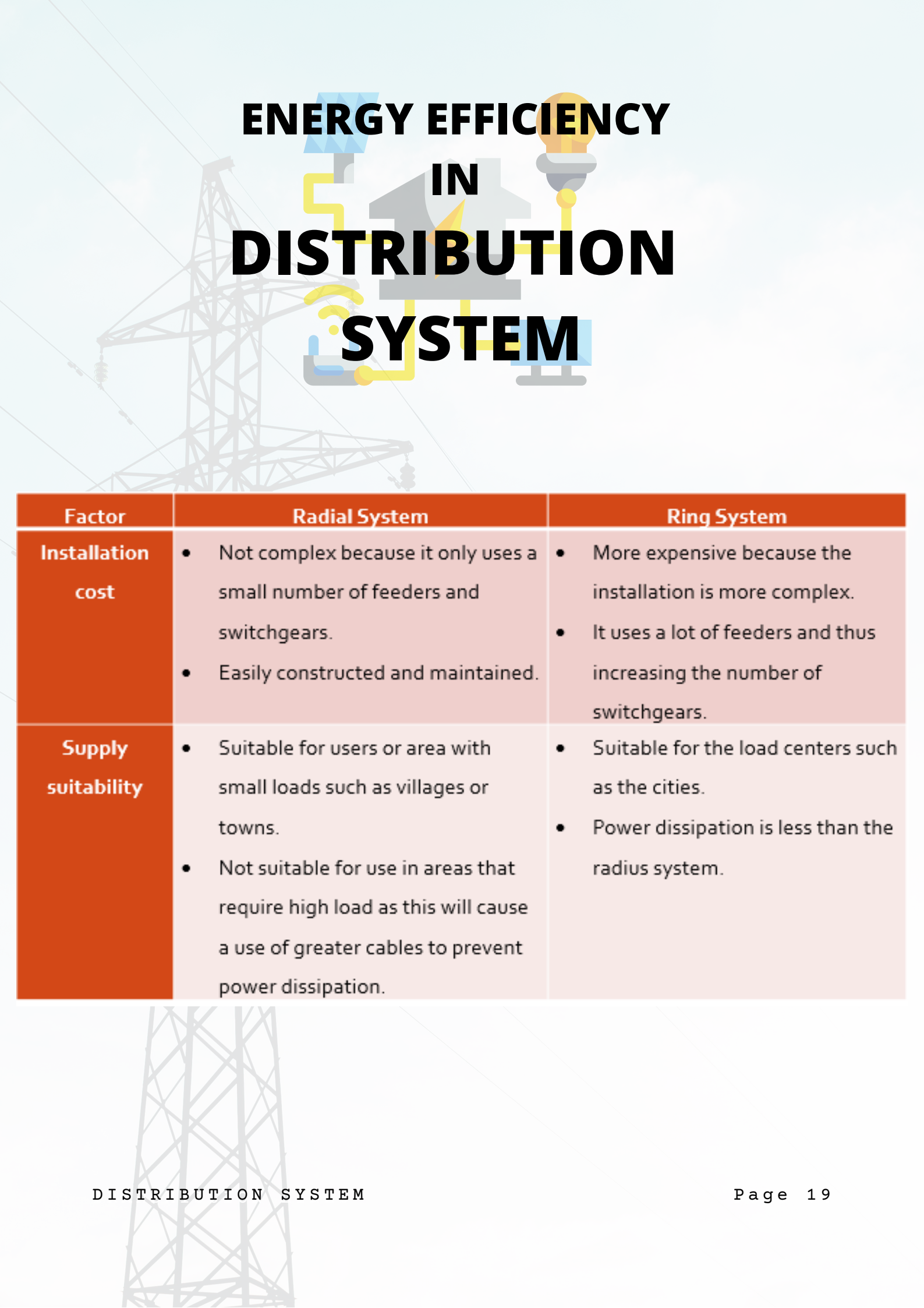
4

SIMPLE NETWORK



- A mixture of the radial and ring system.
- The primary side is made in radial connection while the secondary side is made in ring connection.
- If one of the transformers damaged, the electrical supply to the damaged area of the transformer is still available as part of the secondary transformer circuits are in the ring.

ENERGY EFFICIENCY IN DISTRIBUTION SYSTEM



Factor	Radial System	Ring System
Installation cost	<ul style="list-style-type: none"> Not complex because it only uses a small number of feeders and switchgears. Easily constructed and maintained. 	<ul style="list-style-type: none"> More expensive because the installation is more complex. It uses a lot of feeders and thus increasing the number of switchgears.
Supply suitability	<ul style="list-style-type: none"> Suitable for users or area with small loads such as villages or towns. Not suitable for use in areas that require high load as this will cause a use of greater cables to prevent power dissipation. 	<ul style="list-style-type: none"> Suitable for the load centers such as the cities. Power dissipation is less than the radius system.



DOMESTIC AND INDUSTRIAL USAGE

Domestic	Industrial
Involves residential houses, flats, apartments and others.	Involves manufacturing factories
Residential houses get electricity via single phase system.	Get electricity via 3-phase system with its own substation system.
Loads are lighting, heating, radio, television, washing machines, air-conditioners and refrigerators.	Loads are electric motors, control panels and manufacturing equipment.
Apartments and others get electricity supply via 3-phase system.	Need its own distribution substation without sharing with any other user.



ROLE OF DISTRIBUTION SYSTEM

- Distribution substations receive and reduce the voltage delivered by the transmission substation from 11 kV to 415 V for 3 -phase and to 240V for single phase through transformers.
- Distribution substation can also be divided into two:
 - Indoor Substation
 - Outdoor Substation
- Arrangement of equipment in the substation depends on the type of substation.

Provide services for distribution electricity supply source in some area

Received energy sent in high voltage of generator station and make it low to certain value for distribution local and this need suitable switch gear.

Some substation only function as easy switching station where having different connection between variety transmission line

Change AC supply to DC or otherwise it also exchanged high voltage frequency to low or otherwise.

TYPE OF DISTRIBUTION SYSTEMS



1

Outdoor Substation

The various electrical equipment's are installed in the switchyard below the sky. Placed in mine region, plant



2

Indoor Substation

the apparatus is installed within the substation building
Placed in city, and factories

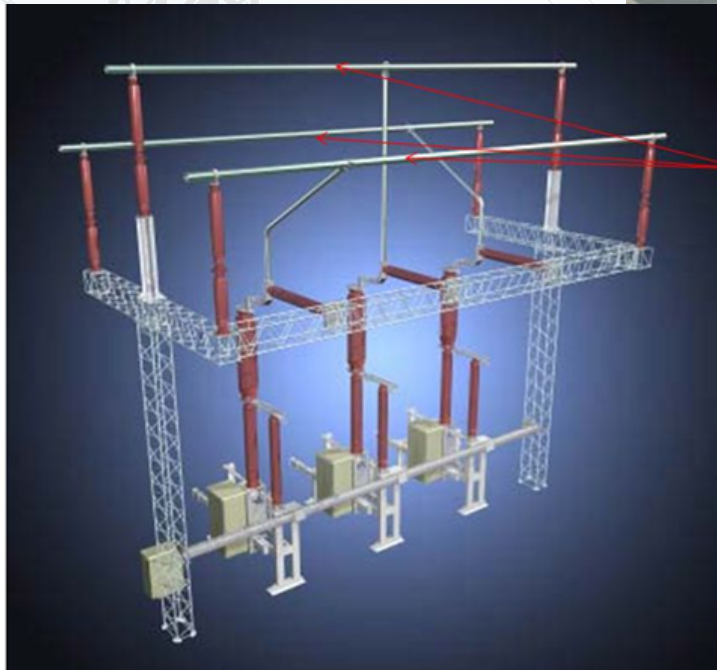
TYPE OF DISTRIBUTION SYSTEMS

The advantages & disadvantages of substation inside & outside of building in term of cost, noise & disturbance

Factor	Indoor substation	Outdoor substation
Installation cost	<ul style="list-style-type: none">- Expensive cost because it requires building materials such as concrete and steel.- Installation of high-voltage equipment in the building made it difficult for maintenance work and also to increase substation capacity.- Costs of maintenance and additions to the exterior of the outdoor substation switchyards will increase.- Due to changes in temperature, dust and dirt, the equipment's should be designed specifically for a good quality of service and will result in higher construction costs.	<ul style="list-style-type: none">- Only requires a small space, little fenced, steel and concrete for placing high-voltage equipment's.
Noise and disturbance	<ul style="list-style-type: none">- More quietly because the noise is not spread out and trapped in the building only.- Switchgears and high voltage equipment's safe from lightning, rain, snow and storms.	<ul style="list-style-type: none">- Noise spread in the surrounding area.- Exposed to environmental hazards such as lightning, changes in temperature, dust and dirt.

BUSBAR ARRANGEMENT IN DISTRIBUTION SYSTEM

WHAT IS BUSBAR?

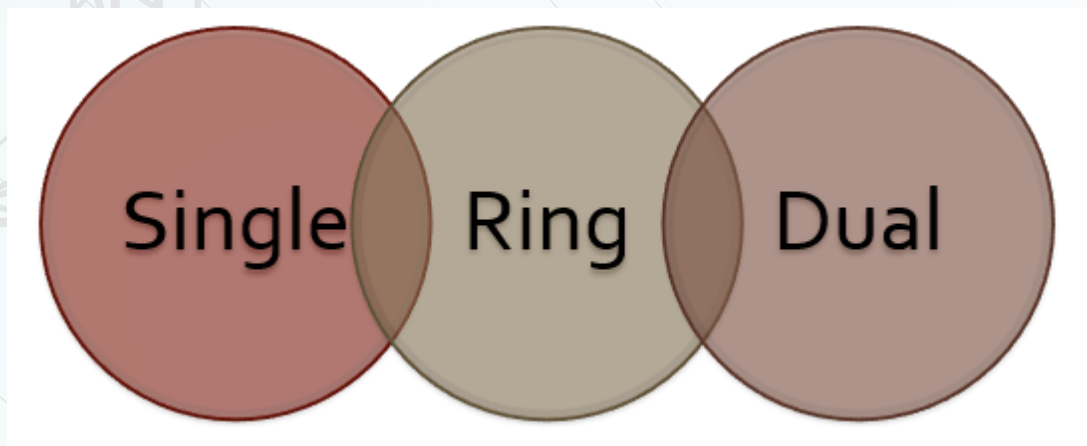


Busbars
(long heavy
tube type)



Thick strips of copper or aluminium that conduct electricity within a switchboard, distribution board, substation, or other electrical apparatus.

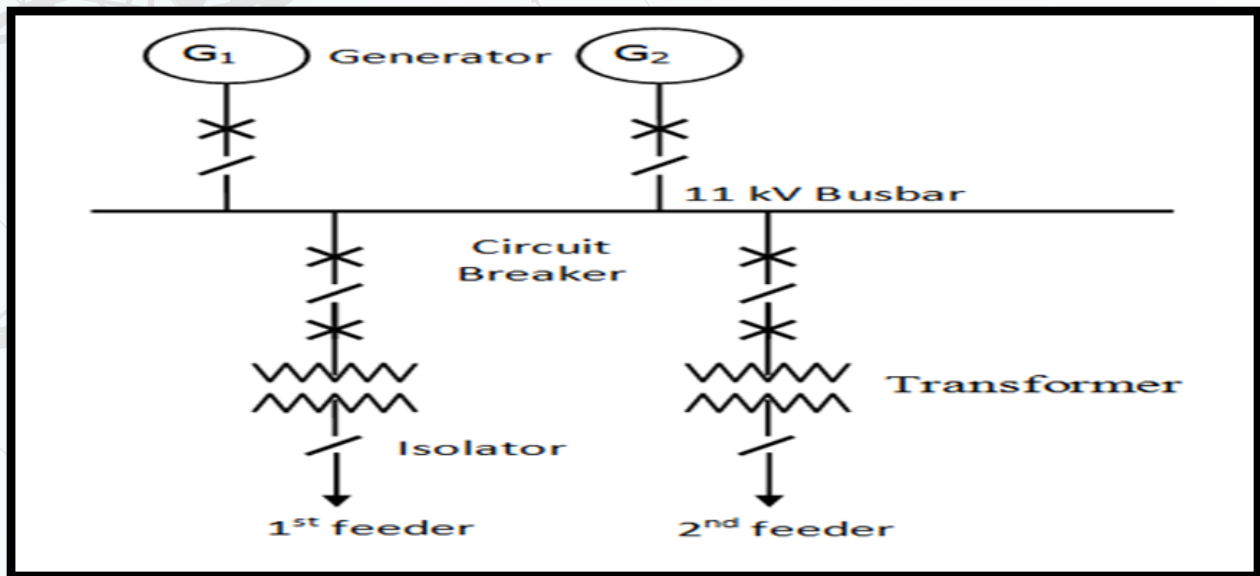
TYPE OF BUSBAR ARRANGEMENT IN DISTRIBUTION SYSTEM



TYPE OF BUSBAR ARRANGEMENT IN DISTRIBUTION SYSTEM

1

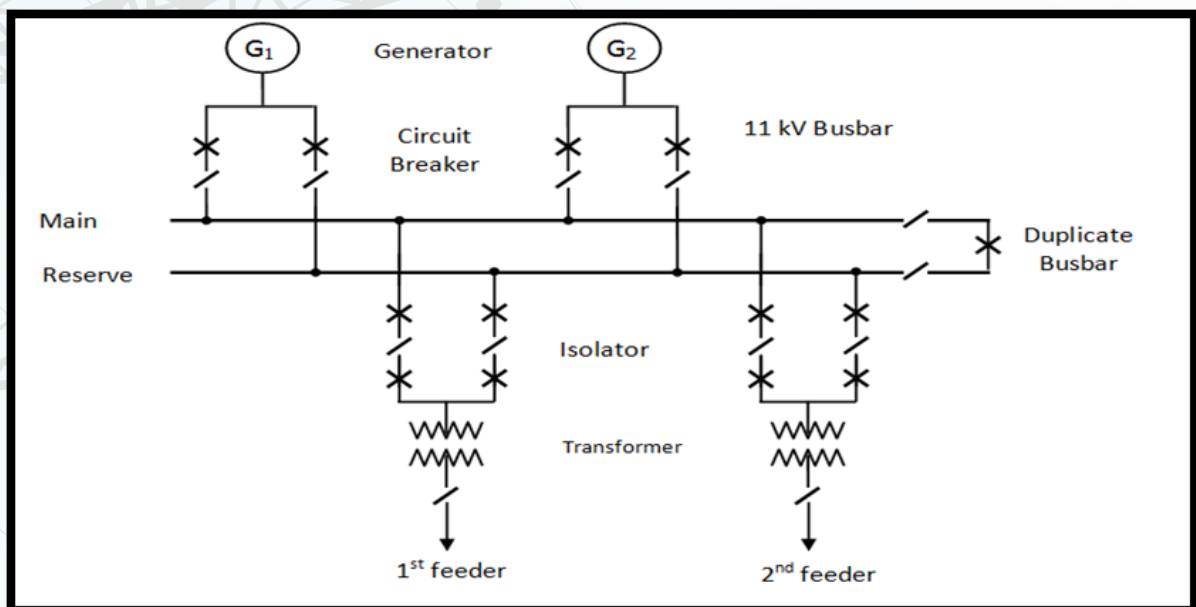
SINGLE BUSBAR



- Each busbar are connected to station generator.
- Busbar are also connected to generator, transformer and feeder via circuit breaker and isolator switch.
- Pair isolator - To check if there is inverting source inside the system.
- Some problems occur in maintenance process

TYPE OF BUSBAR ARRANGEMENT IN DISTRIBUTION SYSTEM

2 *DUAL* BUSBAR

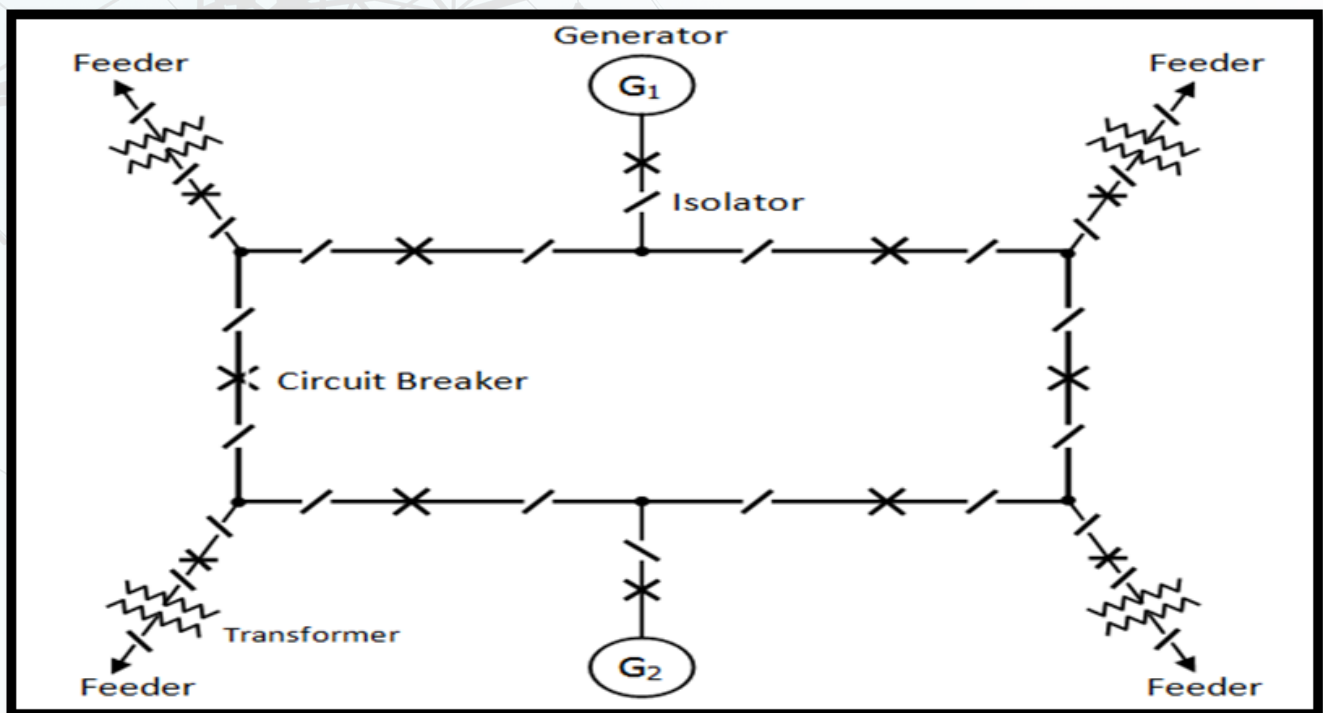


- Consist of 2 duplicate busbar that separated by circuit breaker and isolator switch.
- If one of the busbar damage, power are still can be distribute to consumer using the storage busbar.
- It done by opened the circuit breaker and isolator switch that connected line to feeder with the damage busbar.
- Circuit breaker to feeder must be off.
- The changes of main busbar to storage busbar are done without disturbing the power supply.

TYPE OF BUSBAR ARRANGEMENT IN DISTRIBUTION SYSTEM

3

RING BUSBAR

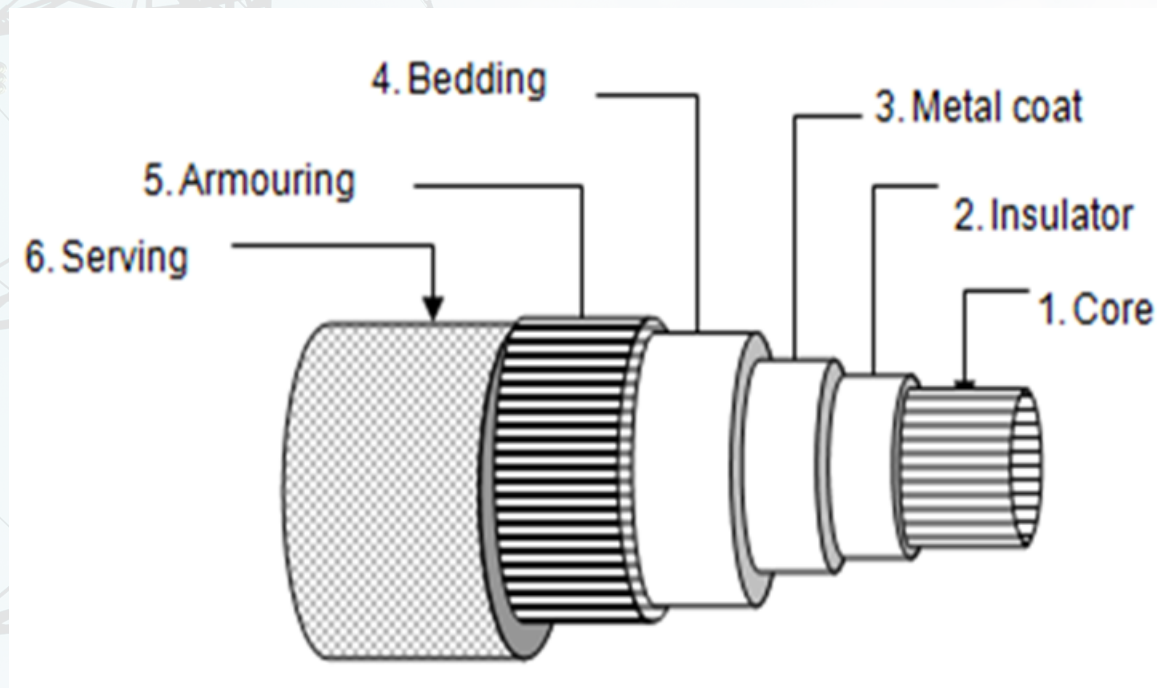


- Loads are connected with power supply.
- Each feeder gets supply from two different sources.
- When problems occur, power supply is not effect.
- Installation cost is quite similar as single busbar.

THE STRUCTURE OF UNDERGROUND DISTRIBUTION CABLES



THE STRUCTURE OF UNDERGROUND DISTRIBUTION CABLES





Parts	Function
Core	Made of aluminum or copper
Insulation	usually use <i>vulcanized bitumen</i> and <i>varnished cambric</i>
Metal coating	Coated on top of the insulation to prevent moisture entrance. The materials used were lead and aluminum.
Bedding	In the outer metal layer is a layer of bedding, made from a combination of paper substitutes. The purpose was to provide protection to the metal coating.
Shielding (Armouring)	Prevent mechanical damage from occurring on the cable. One or two layers of steel wire (galvanized steel wire) or two layers of steel tap used for resurfacing work.
Serving	In the outer part of the shielding layer coated with a layer of cladding similar replacement.

DO YOU KNOW?



DO YOU KNOW??

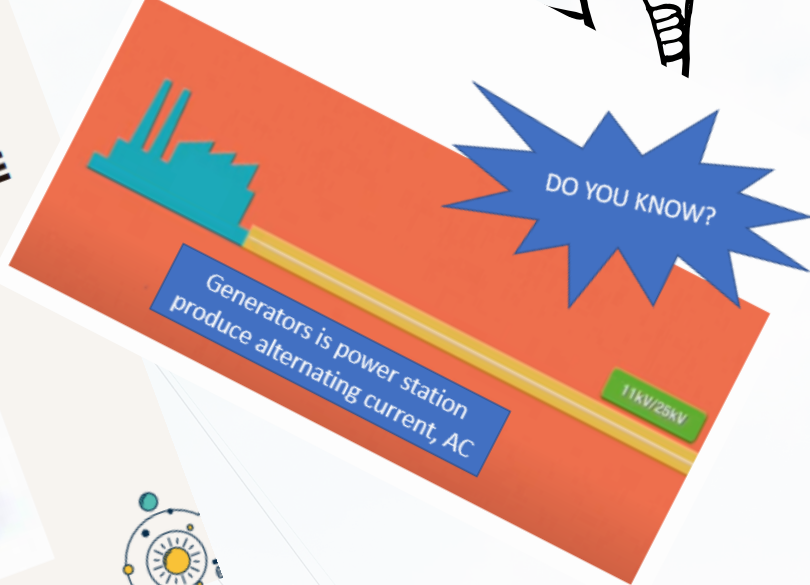
A TRANSFORMER IS A DEVICE USED TO STEP UP OR STEP DOWN THE VOLTAGE



DO YOU KNOW?

Generators in power station produce alternating current, AC

11kV/230kV



DO YOU KNOW?

STEP UP TRANSFORMER

Alternating current voltage is increased to 132kV, 275kV by using a step up transformer.



DO YOU KNOW?

STEP DOWN TRANSFORMER

33kV, 11kV, 230V

Industry, school, Industry, village

The voltage for the alternating current is reduced to different voltage values to be supplied to the users according to their needs.



DO YOU KNOW?



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e ISBN 978-967-0047-09-6



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